

REMARKS

Claims 37-59 are pending in this application. By this Amendment, the abstract and claims 49 and 53 are amended, and new claims 54-59 are added. The abstract is amended to correct to address an objection to the specification. 53 is amended to replace the phrase “characterized in that” with the word “wherein”.

No new matter is added to the application by this Amendment. New claims 54-59 find support within the specification, as originally filed, at, for example, paragraphs [0010]-[0013] of U.S. Patent Publication No. 2005/0262830 for the present application.

Reconsideration of the application is respectfully requested.

I. Specification Objection

The Patent Office objected to the abstract for alleged informalities. This objection is respectfully traversed.

Specifically, the Patent Office objected to the abstract because of the use of the open ended phrase “comprising”.

Applicants submit herewith, on a separate sheet, a revised abstract removing the open ended phrase as requested by the Patent Office.

Applicants submit that the revised abstract overcomes the objection by the Patent Office.

Accordingly, the objection to the abstract should be withdrawn.

II. Rejection Under 35 U.S.C. 103

Claims 37-53 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 5,802,845 to Abe et al. (hereinafter “Abe”). This rejection is respectfully traversed.

Prior to discussing the merits of the Examiner's position, the undersigned reminds the Examiner that the determination of obviousness under § 103(a) requires consideration of the factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1 [148 USPQ 459] (1966): (1) the scope and content of the prior art; (2) the differences between the claims and the prior art; (3) the level of ordinary skill in the pertinent art; and (4) secondary considerations, if any, of nonobviousness. *McNeil-PPC, Inc. v. L. Perrigo Co.*, 337 F.3d 1362, 1368, 67 USPQ2d 1649, 1653 (Fed. Cir. 2003). There must be some suggestion, teaching, or motivation arising from what the prior art would have taught a person of ordinary skill in the field of the invention to make the proposed changes to the reference. *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). But see also *KSR International Co. v. Teleflex Inc.*, 82 USPQ2D 1385 (U.S. 2007).

A methodology for the analysis of obviousness was set out in *In re Kotzab*, 217 F.3d 1365, 1369-70, 55 USPQ2d 1313, 1316-17 (Fed. Cir. 2000) A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood

may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher."

It must also be shown that one having ordinary skill in the art would reasonably have expected any proposed changes to a prior art reference would have been successful. *Amgen, Inc. v. Chugai Pharmaceutical Co.*, 927 F.2d 1200, 1207, 18 USPQ2d 1016, 1022 (Fed. Cir. 1991); *In re O'Farrell*, 853 F.2d 894, 903-04, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988); *In re Clinton*, 527 F.2d 1226, 1228, 188 USPQ 365, 367 (CCPA 1976). "Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure." *In re Dow Chem. Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1988).

The Patent Office acknowledges that Abe fails to disclose that the engine installation is a directly injected gasoline type engine which is adapted for operating in a stratified manner only to a small extent in terms of all operation points of the direct injected gasoline engine. The Patent Office alleges that it would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Abe to a directly injected gasoline type engine, since the recitation of such amounts to an intended use statement. Additionally, the Patent Office alleges that both "directly injected gasoline engine" and "carburetor gasoline engine" generate exhaust gases containing harmful emissions of HC, NO_x, soot, CO, etc, that require purification before the gases can be released to the atmosphere; and the mere selection of the purification system of Abe for use in a directly injected gasoline engine would be well within the level of ordinary skill in the art.

In response to previous Amendment filed on April 2, 2009, the Patent Office further

alleges that Abe clearly teaches a catalyst system having a total catalyst volume of less than 0.8 x the engine displacement because Abe teaches “the volume of the catalyst A is in the range of 50 to 200% of the displacement of engine. The catalyst A may be constituted of a single honeycomb structure or a plurality of the honeycomb structures.” Moreover, the Patent Office alleges that Abe teaches a catalyst system having an average specific noble metal loading of the catalyst system is less than 3.59 g/dm³ because Abe teaches “the total amount of the supported noble metal in the catalyst is in the range of 20 to 130 g/ft³.” Applicants respectfully disagree with the allegations made by the Patent Office.

Claim 37 requires an internal combustion engine installation having a directly injected gasoline engine, which is not adapted for operating in a stratified manner or is adapted for operating in a stratified manner only to a small extent in terms of all operation points of the direct injected gasoline engine, and a catalyst system, which is downstream from the directly injected gasoline engine and has at least one catalyst. The catalyst system of claim 37 has (a) a total catalyst volume (KV) of less than 0.8 x the engine displacement (VH) or of less than 1.3 L per 100 kW of rated horsepower (PNENN), (b) an average specific noble metal loading of the at least one catalyst of the catalyst system that is less than 3.59 g/dm³, and (c) a total mass of noble metal of the catalyst system being less than 2 g per liter of the engine displacement (VH) or less than 3.5 g per 100 kW of rated horsepower (PNENN) of the gasoline engine.

Contrary to the allegations made by the Patent Office, Applicants submit that a catalyst (or a catalytic converter) is defined as “a device used to reduce the toxicity of emissions from an internal combustion engine” by providing “an environment for a chemical reaction wherein toxic

combustion by-products are converted to less-toxic substances” (see the definition of catalytic converter accessible at the website: http://en.wikipedia.org/wiki/Catalytic_converter_). Further, Applicants submit that each component in an exhaust tract of an internal combustion engine that has a catalytic function and thus contributes to the conversion of combustion by-products has to be considered as a catalyst within the meaning of present claim 37.

Abe explicitly discloses the contribution of the adsorber as well as of the EHC to the total catalytic activity of the catalytic system. For instance, Abe discloses “It is apparent from the foregoing, when supported on the zeolite [of the adsorbent], the noble metal has not only the recovery ability of the zeolite but also a catalytic function. [...] In this case, since containing the durable catalyst component, the adsorbent can suitably and conveniently exert the purification performance.” (see col. 6, lines 33-47 of Abe). Abe also discloses “...the HC desorbed from the adsorbent component can be purified by the catalyst component in the adsorbent, which leads to the improvement of the purification performance. For the same purpose, the EH can be coated with the adsorption layer, and the catalyst component may be included in this adsorption layer. [...] In the case the EH is coated with the catalyst layer, at least partially desorbed HC can be purified with the catalyst component on the EH.” (see col. 7, line 60 – col. 8, line 11 of Abe). Thus, Abe teaches that both the adsorbent and the electric heater have catalytic activity. Accordingly, Applicants submit that, when calculating the total catalyst volume and the total noble metal loading, both the adsorbent and EHC must also be considered as components of the catalyst system within the meaning of the present claims.

With respect to the total catalyst volume in relation to the engine displacement, Applicants submit that Abe discloses an engine displacement of 3,800 cc (= 3.8 L) in the examples illustrated in FIGS. 4-11 of Abe (see col. 13, lines 51-59 of Abe). In Abe's examples (illustrated FIGS. 4-7 and 9-10), even when taking catalyst A (3.4 L) as the only catalyst of the catalyst system in accordance with the allegations made by the Patent Office, this arrangement corresponds to a total catalyst volume of about 0.9 times the engine displacement. Allocating also the adsorbent and the catalytic electric heater EHC to the catalyst system according to Applicants' contentions, the total volume of the catalyst system of Abe is even greater. Accordingly, Abe does not teach a catalyst system having less than 0.8 times the engine displacement as specifically defined in the present claims.

With respect to the total mass of noble metal of the catalyst system, Abe's examples illustrated in FIGS. 4-7 and 9-10, even when taking catalyst A ($80 \text{ g/ft}^3 = 2.82 \text{ g/L}$ corresponding to 9.6 g noble metal) as the only catalyst of the catalyst system, this arrangement corresponds to a total mass of noble metal of the catalyst system of about 2.5 g per liter engine displacement. Thus, Abe also fails to teach a total mass of noble metal of the catalyst system of less than 2 g per liter engine displacement as set forth in the present claims.

With respect to the Patent Office's allegations that it would have been obvious to a skilled artisan to apply the invention of Abe to a directly injected gasoline type engine and that mere selection of the purification system of Abe for use in a directly injected gasoline engine would be well within the level of ordinary skill in the art, Applicants submit that a skilled artisan would not apply the invention of Abe to a directly injected gasoline type engine because there are

substantial differences exist between the engine types. More specifically, there are substantial differences between the presently claimed direct-injection gasoline engine and Abe's carburetor gasoline engine or intake-manifold fuel injection engines. Carburetor gasoline engines, similar to Abe's engine, have considerable higher raw emissions, in particular of hydrocarbons (hereinafter "HC"). Because of these relative high raw emissions associated with carburetor gasoline engines, a catalyst system, that is comparably small dimensioned in terms of its volume and noble metal loading as required by the present claims, would not ensure a sufficient catalytic efficiency which is required by law, for instance by the EU IV norm as disclosed in the present specification (see paragraph [0009] of present application). In particular, during a cold start of the engine, when the converter is not yet activated, direct-injection engines have low raw emission values compared to carburetor engines. In addition, the arrangement of the fuel injector directly in the combustion chamber of the presently claimed directly injected gasoline engine allows to perform a split injection mode during the warm-up and, thus, a quick heating of the catalyst(s) which is not possible in case of carburetor engines.

Accordingly, Applicants submit that Abe fails to teach or suggest a directly injected gasoline engine which is not adapted for operating in a stratified manner or is adapted for operating in a stratified manner only to a small extent in terms of all operation points of the direct injected gasoline engine as recited in claim 37. Abe also fails to teach or suggest a catalyst system having a total catalyst volume (KV) of less than $0.8 \times$ the engine displacement (VH) or of less than 1.3 L per 100 kW of rated horsepower (PNENN), and a total mass of noble metal of the catalyst system being less than 2 g per liter of the engine displacement (VH) or less than 3.5 g per

100 kW of rated horsepower (PNENN) of the gasoline engine as required by claim 37.

Because these features of independent claim 37 are not taught or suggested by Abe, this reference would not have rendered the features of independent claim 37 and its dependent claims obvious to one of ordinary skill in the art.

For at least these reasons, claims 37-53 are patentable over Abe. Thus, withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

III. New Claims

In addition to all the foregoing reasons, Abe fails to teach or suggest a directly injected gasoline engine, which is not adapted for operating in a stratified manner or is adapted for operating in a stratified manner only to a small extent in terms of all operation points of the direct injected gasoline engine, wherein the directly injected gasoline engine has an injection nozzle installed in a region from -20° to $+50^{\circ}$ relative to a circular cross-section of a cylinder of the directly injected gasoline engine, wherein a negative degree corresponds to an alignment with respect to the cylinder head, wherein 0° corresponds to an alignment parallel to the circular cross-section of the cylinder, and further wherein a positive degree corresponds to an alignment in the direction of the crank-shaft as required by new claim 54.

Further, Abe fails to teach or suggest a directly injected gasoline engine, which is not adapted for operating in a stratified manner or is adapted for operating in a stratified manner only to a small extent in terms of all operation points of the direct injected gasoline engine, wherein the directly injected gasoline engine has an injection nozzle, wherein a center position of an

injection jet at an outlet of an injector of the injection nozzle has an injection angle ranging from -5° to -45° or 70° to 90° , relative to the circular cross-section of the cylinder, wherein a negative degree corresponds to an alignment with respect to the cylinder head, wherein 0° corresponds to an alignment parallel to the circular cross-section of the cylinder, and further wherein a positive degree corresponds to an alignment in the direction of the crank-shaft as required by new claim 57.

Moreover, Abe fails to teach or suggest a catalyst system that has a total catalyst volume (KV) of less than $0.8 \times$ the engine displacement (VH) or of less than 1.3 L per 100 kW of rated horsepower (PNENN), wherein an average specific noble metal loading of the at least one catalyst of the catalyst system is less than 3.59 g/dm^3 , and further wherein a total mass of noble metal of the catalyst system being less than 2 g per liter of engine displacement (VH) or less than 3.5 g per 100 kW of rated horsepower (PNENN) of the directly injected gasoline engine as recited in new claims 54 and 57.

IV. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 37-59 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Early and favorable action is earnestly solicited.

CONDITIONAL PETITION FOR EXTENSION OF TIME

If entry and consideration of the amendments above requires an extension of time, Applicants respectfully request that this be considered a petition therefor. The Commissioner is authorized to charge any fee(s) due in this connection to Deposit Account No. 14-1263.

ADDITIONAL FEE

Please charge any insufficiency of fees, or credit any excess, to Deposit Account No. 14-1263.

Respectfully submitted,

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